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Neanderthal skulls belonging to a prehistoric race, I also append, for the purposes of comparison, the measurements of the true mound-builders' skulls described in this paper :

TABLE OF MEASUREMENTS.

NATIONALITY.	A.	B.	C.	D.	E.	F.
English.....	21	13.75	12.50	4.40	7.87	5.33
Australian (No. 1).....	20.50	13	12	4.75	7.50	5.40
“ (No. 2).....	22	12.50	10.75	3.80	7.90	5.75
Engis, Belgium.....	20.50	13.75	12.50	4.75	7.75	5.25
Neanderthal, Prussian Empire.....	23	12	10	3.75	8	5.75
Merom, Indiana (No. 4).....	20.50	12.87	11.25	4	7.25	5.50
“ “ (No. 5).....	20.62	12.87	12	3.87	7.37	5.37
“ “ (No. 6).....	19.50	12.50	11.62	4.37	6.62	5.62
“ “ (No. 7).....	21	13.50	12.50	4.12	7.12	6
Chicago, Illinois (No. 1).....	20.25	12.50		3.80	7.60	5.75
La Porte, Indiana.....	18.50	10.50	10.30	3.80	6.50	5

- A. The horizontal circumference in the plane of a line joining the glabella with the occipital protuberance.
 B. The longitudinal arc from the nasal depression along the middle line of the skull to the occipital tuberosity.
 C. From the level of the glabello-occipital line on each side, across the middle of the sagittal suture to the same point on the opposite side.
 D. The vertical height from the glabello-occipital line.
 E. The extreme longitudinal measurement.
 F. The extreme transverse measurement.

ON THE RELATION BETWEEN ORGANIC VIGOR AND SEX.

BY HENRY HARTSHORNE, M.D.*

THE observations of Thomas Meehan upon the relations of sex in plants, published in the “Transactions of the American Association for Advancement of Science,” and elsewhere, are entitled to the attentive consideration not only of botanists but also of students of general biology. In his papers of 1868, '69 and later, Mr. Meehan has endeavored to show that “it is the highest types

* Read at the Dubuque Meeting of the American Association for the Advancement of Science, August, 1872.

of vitality only which take on the female form.”* His facts have referred mainly to *Coniferæ* and *Amentaceæ*, although not confined to them.

The hesitation felt by many minds in regard to the acceptance of the above proposition has originated, chiefly, from the familiarity of the principle that “there is a certain degree of antagonism between the nutritive and the generative functions, the one being executed at the expense of the other;” along with the weight of some very familiar facts concerning the generally greater size and muscular strength of the male among animals (with a few exceptions, as in certain raptorial birds and arachnida), as well as the equally general superiority of male birds in voice and plumage.

Some of the facts in regard to plants cited in the papers referred to may *possibly* bear a different, even an opposite, interpretation to that given by Mr. Meehan. In his example of the larch, for instance, when we notice that after surviving several years of the repeated production of female flowers, the branches or spurs “bear male flowers and die†,” is it not possible that the demand for organic force required in the evolution of male flowers *causes* their exhaustion? In another place‡ Mr. Meehan speaks of “the loss of power to branch,” which in the Scotch pine, “the formation of male flowers induces.” This view might comport, at least, with the ordinary statements of physiologists, as represented by Dr. Carpenter§ who refers to the contrast between *Algæ*, in which individual construction is especially active, while the fructifying organs are obscure, and fungi, in which almost the whole plant seems made up of reproductive organs, upon the maturing of which the plant ceases to exist. This contrast between nutrition and reproduction appears again in the larval and perfect stages of insect life; the one being devoted to nutrition and the other to reproduction. Is there any doubt that, in the dahlia and other *Compositæ* cultivation alters *fertile* florets of the disk into *barren* florets of the ray? The gardener’s common use of the principle of *limiting nutrition for the increase of reproduction* is alluded to by Mr. Meehan in his paper of 1870,|| in speaking of a branch being “partially ringed to produce fruitfulness.”

* *Proc. of Am. Assoc. for Adv. Science*, 1869, p. 260.

† *Proc. Am. Assoc. for Adv. Science*, 1869, p. 257.

‡ *Proc. Acad. Nat. Sciences, Phila.* 1869, No. 2, p. 122.

§ *Principles of Comparative Physiology*, p. 147.

|| *Proc. of Am. Assoc. for Adv. Science*.

But my purpose in the present paper is especially to call attention to a few well known facts in the animal kingdom, of a character somewhat analogous to those dwelt upon above concerning plants; which conspire with these, in suggesting that some qualification or addition may be required to the ordinary statements concerning the relations between nutrition and reproduction; or at least as to those between organic vigor and sex.

Take the instance of the common hive-bee (*Apis mellifica*). According to the observations of Dzierzon, Von Siebold, Leuckart and Tegetmeier upon hive-bees, and of F. W. Putnam, J. Wyman and Gerstæcker upon humble-bees, it appears that there is a regular gradation in rank, so to speak, of bee offspring, according to the method of their production. First and lowest in the hive-bee series are the males or drones. These may be sometimes produced by an unfertilized working bee; commonly, by a queen bee from ova not fertilized with sperm-cells, which cells, as observation and experiment both have shown, may be for a long time detained in the spermatheca charged with them. A queen whose fecundation has been delayed till she is older than usual, is apt to yield only drone offspring. The next stage in rank is that of the worker, or undeveloped female. Every one knows the remarkable effect of nutrition upon its characters; a change of cell and food elevating it to the full endowments of a queen. Putnam and Gerstæcker* have noticed among humble-bees what are called "large queen larvæ," intermediate between the workers and the perfect queens; and Wyman has suggested that the earlier or later period of impregnation may determine this difference; those first impregnated becoming queens, then the large queen larvæ, next the workers, *last the males*.

Now among the Aphides as well as to a certain extent in some Molluscoida, Cœlenterata, etc., we find a class of facts, different from these but yet allied to them. Taking Huxley's summary of the history of aphidian parthenogenesis,† it seems that the number of successive viviparous *pseudovan* broods is "controlled by temperature and the supply of food." The *agamie* viviparous individuals are regarded by Steenstrup and others as *non-sexual*. If sexual, they must be considered as females undeveloped. At all events, the coming on of cold weather begins the production of

* Packard's "Guide to the Study of Insects," p. 119.

† Linnæan Transactions, xxii, p. 198.

males as well as females. Packard's expression is that "the asexual Aphis and the perfect female may be called dimorphic forms." Of the three forms, then, that one whose production especially attends the conditions of the lowest vitality is the *male*.

But another class of facts of a quite different kind may be considered in this connection; involving higher animals and even man himself. I refer to the history of monstrosities. Double monsters (of which some remarkable human instances have been exhibited within a few years in this country) are always of one sex and *nearly always of the female sex*.* There is reason to exclude from this class of true double monsters cases like that of the Siamese Chang and Eng, who may be regarded as really twins with two complete bodies abnormally united together.

Now, why should a double fœtus nearly always have the female sex? The bearing of this question upon that which we have just been discussing appears, when we consider the true theory of double monsters. Under the close investigations of St. Hilaire, Virchow, Vrolik, Fisher and others† it has been made quite evident that they result not at all from the fusion of two embryos into one, but, on the contrary, from the abnormal *fission of a single ovum*, under *excess of formative force*. The point for us now to notice is the nearly constant association of this profusion of developmental force with femininity of sex.

Regarding the actual function of this force (however we may designate it, as, *e. g.*, life force, organic force, bio-plastic force, etc.) as being the formation of plasma with attendant cell-multiplication or *vegetative repetition*, it would appear that *this* is precisely what, in plants and animals, may be the especial feminine endowment. The two directions or modes of manifestation of this organic force are individual construction and reproduction. These may, therefore, be in inverse proportion to each other, simply because the energy or material consumed in the one process is taken from the other; and yet, while a *certain* limitation of food and temperature favors reproduction, rather than individual nutrition and construction, a *greater* lowering of these conditions of vitality will retard, arrest or degrade both processes. According to Meelian's interpretation of his facts concerning plants,

*G. J. Fisher, Trans. Med. Soc. of New York, 1865-1868. Against this I find only a vague expression of W. Vrolik (Cyclop. of Anat. and Physiol., Art. *Teratology*, p. 946) that "some sorts" of double monsters are more frequently male.

† Goodell, Philada. Med. Times, June 15, 1871.

one effect of this lowering, retardation or degradation is the production of the male rather than the female sex. Some facts, at least, in the animal kingdom, as we have seen, support the same view; but to give a statement of this kind the form and validity of a law would require a much more extensive survey of correlated facts. At all events, we do not find the frequent superiority of the masculine sex in certain particulars in the higher animals necessarily incompatible with this; since this superiority prevails usually in apparatus not of the functions of the *vegetative* or organic life, but of *animal* life or of relation; as of *intellection*, *motor* power and *voice*. Beauty of plumage in birds, while we naturally attribute to it a certain superiority, may not, in the scientific sense, unequivocally have this character. If it should be conceded that it has, we must then regard its general predominance in males as one of the difficulties in the way, at present, of any extended or final generalization upon the subject. (The remainder of the paper was occupied with the application of the same course of reasoning to the study of the law of increase of human population.)

ON THE GEOLOGY OF THE ISLAND OF AQUIDNECK AND THE NEIGHBORING PARTS OF THE SHORES OF NARRAGANSET BAY.—No. III.

BY PROF. N. S. SHALER.

PHYSICAL CONDITIONS OF THE CARBONIFEROUS TIME.—The island of Aquidneck is so far separated from the mainland that we cannot directly refer by traced contact any of its rocks to the masses of the shore. It is not difficult, however, to find a dating point in the materials of the island itself. The extensive coal deposits with their abundant carboniferous fossils make us reasonably sure that a large part of the island is composed of rocks which were laid down at the time when the great coal fields of other parts of the continent were being formed. As the rocks of this part of the section are much better determined than those of any other part of the island, it will be well to begin with them and from them to go to those which cannot be so readily placed in their proper positions in the succession of deposits.